SUBSTITUTE FORM PTO-1390 U.S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER
12816-031001

U.S. APPLICATION NO. (If Known, see 37 CFR 1.5)
10/031471

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/02294	13 July 2000	16 July 1999

TITLE OF INVENTION
METHOD FOR DIGITALLY RECORDING AN ANALOG AUDIO SIGNAL WITH AUTOMATIC INDEXING

APPLICANT(S) FOR DO/EO/US
Christian Legl and Michael Hermann

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. ☒ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 16 below concern other documents or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
    ☒ International Search Report
    ☒ International Preliminary Examination Report
    ☐
    ☐
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Leroy Jenkins
Typed Name of Person Signing

U.S. APPLICATION NO. (IF KNOWN)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/031471	PCT/DE00/02294	12816-031001

17. ☒ The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)- (5)):

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO..... **$1040**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740**

International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710**

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$100**

	CALCULATIONS PTO USE ONLY	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$890.00	
Surcharge of **$130** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$0.00	

Claims	Number Filed	Number Extra	Rate		
Total Claims	36 - 20 =	16	x **$18**	$288.00	
Independent Claims	4 - 3 =	1	x **$84**	$84.00	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)			+ **$280**	$0.00	
TOTAL OF ABOVE CALCULATIONS =				$1,262.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				$0.00	
SUBTOTAL =				$1,262.00	
Processing fee of **$130** for furnishing the English Translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f))				$0.00	
TOTAL NATIONAL FEE =				$1,262.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$0.00	
TOTAL FEES ENCLOSED =				$1,262.00	
				Amount to be refunded:	$
				Charged:	$

a. ☒ A check in the amount of $1,262.00 to cover the above fees is enclosed.
b. ☐ Please charge my Deposit Account No. 06-1050 in the amount of $0.00 to cover the above fees. A duplicate copy of this sheet is enclosed.
c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 06-1050. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status.

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NAME

41,942
REGISTRATION NUMBER

Attorney's Docket No.: 12816-031001 / S1133

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Christian Legl et al	Art Unit	: Unknown
Serial No.	: Not yet assigned	Examiner	: Unknown
Filed	: Herewith		
Title	: METHOD FOR DIGITALLY RECORDING AN ANALOG AUDIO SIGNAL WITH AUTOMATIC INDEXING		

Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Prior to examination, please amend the application as follows:

In the specification:

On page 1, line 1, delete "Description"

On page 1, line 5, insert -- FIELD OF INVENTION --

On page 1, line 10, insert -- BACKGROUND –

On page 2, line 16, insert -- SUMMARY –

On page 2, delete the paragraph beginning at line 31.

Replace the paragraph beginning at page 3, line 36 with the following rewritten paragraph:

-- An advantage of the invention is that the peak computation power required is lower because the decision regarding whether the audio data are audio information data or signal pause duration data does not need to be made in real time by the processor. Another advantage is that various different data post-processing methods or algorithms can be used alternatively on the stored audio data, and ultimately that algorithm which has the best result can be used. --

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January 15, 2002
Date of Deposit

Signature

Leyday Jenkins
Typed or Printed Name of Person Signing Certificate

[redacted]

On page 7, line 19, insert -- DETAILED DESCRIPTION --

In the claims:

Please cancel claims 1 – 16 and insert claims 17 – 52 as shown below:

-- 17. (New) A method for digitally recording an analog audio signal with automatic indexing, having the following steps:

(a) an analog audio signal containing audio information and signal pauses is read in;

(b) the analog audio signal is converted into digital audio data comprising audio information data and signal pause duration data;

(c) the audio information data are stored as information data blocks and the signal pause duration data are stored as signal pause data blocks in a memory; and

(d) the stored data blocks are read sequentially and a data structure for managing the indexing is produced, any succession of information data blocks which is not interrupted by a signal pause with a pre-determined duration being detected as one cohesive audio information data sequence whose start and end are stored in the data structure for managing and indexing. --

-- 18. (New) The method of claim 17, wherein the data structure produced for managing the indexing is an index table. --

-- 19. (New) The method of claim 18, wherein the start and end of a cohesive audio information data sequence are stored as start address for the first information data block and as end address for the last information data block within the memory in address pointers of the index table. --

-- 20. (New) The method of claim 18, wherein the sequentially read data blocks are subjected to data processing during production of the index table. --

-- 21. (New) The method of claim 20, wherein, during the data processing, a succession of information data blocks between two signal pause data blocks is filtered out if the number of information data blocks does not exceed a particular minimum value and the signal pause of the two adjacent signal pause data blocks exceeds a particular first time limit value. --

-- 22. (New) The method of claim 21, wherein the minimum value is 1. --

-- 23. (New) The method of claim 21, wherein the first time limit value is 0.5 seconds. --

-- 24. (New) The method of claim 20, wherein, during the data processing, the signal duration data of signal pause data blocks whose signal pause duration exceeds a particular second time limit value are overwritten with signal duration data having a particular nominal signal duration. --

-- 25. (New) The method of claim 24, wherein the second time limit value is 10 seconds and the nominal signal duration is 2 seconds. --

-- 26. (New) The method of claim 17, wherein the digital audio data are compressed before storage. --

-- 27. (New) The method of claim 17, wherein each information data block contains an information data block identifier and audio information data, and each signal pause data block contains a signal pause data block identifier and signal pause duration data. --

-- 28. (New) The method of claim 17, wherein all the data blocks are of the same size and correspond to a particular basic unit of duration. --

-- 29. (New) The method of claim 28, wherein the basic unit of duration is 30 ms. --

-- 30. (New) The method of claim 17, wherein a succession of information data blocks which is not separated by a signal pause data block whose signal pause duration data amount to a signal pause of more than 2 seconds is detected as a cohesive audio information data sequence. --

-- 31. (New) The method of claim 17, wherein, when the analog audio signal is read in, the playing speed of a data medium on which the analog audio signal is recorded can be set. --

-- 32. (New) A method for digitally recording an analog audio signal with automatic indexing having the following steps:

(a) an analog audio signal containing audio information and signal pauses is read in;

(b) the analog audio signal is converted into digital audio data comprising audio information data and signal pause duration data;

(c) the converted digital audio data are stored;

(d) the stored digital audio data are read sequentially;

(e) a decision is made regarding whether the read digital audio data are audio information data or signal pause duration data;

(f) the audio information data are stored as information data blocks and the signal pause duration data are stored as signal pause data blocks in a memory; and

(g) the stored data blocks are read sequentially in order to produce a data structure for managing the indexing, any succession of information data blocks which is not interrupted by a signal pause with a pre-determined duration being detected as one cohesive audio information data sequence whose start and end are stored in the data structure for managing the indexing. --

-- 33. (New) The method of claim 32, wherein the data structure produced for managing the indexing is an index table. --

-- 34. (New) The method of claim 33, wherein the start and end of a cohesive audio information data sequence are stored as start address for the first information data block and as end address for the last information data block within the memory in address pointers of the index table. --

-- 35. (New) The method of claim 33, wherein the sequentially read data blocks are subjected to data processing during production of the index table. --

-- 36. (New) The method of claim 35, wherein, during the data processing, a succession of information data blocks between two signal pause data blocks is filtered out if the number of information data blocks does not exceed a particular minimum value and the signal pause of the two adjacent signal pause data blocks exceeds a particular first time limit value. --

-- 37. (New) The method of claim 36, wherein the minimum value is 1. --

-- 38. (New) The method of claim 36, wherein the first time limit value is 0.5 seconds. --

-- 39. (New) The method of claim 35, wherein, during the data processing, the signal duration data of signal pause data blocks whose signal pause duration exceeds a particular second time limit value are overwritten with signal duration data having a particular nominal signal duration. --

-- 40. (New) The method of claim 39, wherein the second time limit value is 10 seconds and the nominal signal duration is 2 seconds. --

-- 41. (New) The method of claim 32, wherein the digital audio data are compressed before storage. --

-- 42. (New) The method of claim 32, wherein each information data block contains an information data block identifier and audio information data, and each signal pause data block contains a signal pause data block identifier and signal pause duration data. --

-- 43. (New) The method of claim 32, wherein all the data blocks are of the same size and correspond to a particular basic unit of duration. --

-- 44. (New) The method of claim 43, wherein the basic unit of duration is 30 ms. --

-- 45. (New) The method of claim 32, wherein a succession of information data blocks which is not separated by a signal pause data block whose signal pause duration data amount to a signal pause of more than 2 seconds is detected as a cohesive audio information data sequence. --

-- 46. (New) The method of claim 32, wherein, when the analog audio signal is read in, the playing speed of a data medium on which the analog audio signal is recorded can be set. --

-- 47. (New) A method comprising:

reading in an analog audio signal containing audio information and signal pauses;

converting the analog audio signal into digital audio data having audio information data and signal pause duration data;

storing the audio information data as information data blocks in a memory;

storing the signal pause duration data as signal pause data blocks in the memory;

sequentially reading the stored data blocks from the memory; and

storing the start address and end address of a succession of information data blocks which is not interrupted by a signal pause with a pre-determined duration in an index table. --

-- 48. (New) The method of claim 47, further comprising filtering out a succession of information data blocks between two adjacent signal pause data blocks when the number of information data blocks does not exceed a particular minimum value and the signal pause of each of the two adjacent signal pause data blocks exceeds a particular first time limit value. --

-- 49. (New) The method of claim 48, further comprising overwriting the signal pause duration data of signal pause data blocks whose signal pause duration exceeds a particular second time limit value with signal pause duration data having a predetermined signal pause duration. --

-- 50. (New) An apparatus comprising:

an analog audio signal input for receiving an audio signal;

an analog-to-digital converter for converting the analog audio signal into digital audio data having audio information data and signal pause duration data;

a memory configured to store audio information in information data blocks and to store signal pause duration data in signal pause data blocks;

a data processor configured to read sequentially the stored data blocks and storing the start address and end address of a succession of information data blocks which is not interrupted by a signal pause with a first predetermined duration in an index table in the memory. --

-- 51. (New) The apparatus of claim 50 wherein the data processor is further configured to filter out a succession of information data blocks between two signal pause data blocks when the number of information data blocks is less than a predetermined number and the signal pause of each of the two adjacent signal pause data blocks exceeds a predetermined time threshold. --

-- 52. (New) The apparatus of claim 50 wherein the data processor is further configured to overwrite the signal pause duration data of signal pause data blocks whose signal pause duration exceeds a second predetermined duration with signal pause duration data having a third predetermined duration that is less than the second predetermined duration. --

REMARKS

Applicant amends the claims to more clearly point out the subject matter of the invention and to eliminate multiple dependent claims.

Now pending in this application are claims 17 – 52.

Attached is a marked-up version of the changes being made by the current amendment.

No additional fees are believed to be due in connection with the filing of this preliminary amendment. However, in the event that additional fees are due, please adjust out Deposit Account No. 06-1050.

Respectfully submitted,

Date: Jan 15, 2002

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Version with markings to show changes made

In the specification:

Paragraph beginning at page 3, line 36 has been amended as follows:

-- An advantage of the invention is that [In the inventive method according to patent claim 2,] the peak computation power required is lower because the decision regarding whether the audio data are audio information data or signal pause duration data does not need to be made in real time by the processor. Another advantage is that various different data postprocessing methods or algorithms can be used alternatively on the stored audio data, and ultimately that algorithm which has the best result can be used. --

3/pdb

Description

Method for digitally recording an analog audio signal with automatic indexing

The invention relates to a method for digitally recording an analog audio signal with automatic indexing, in particular for language learning appliances for learning foreign languages.

In language learning machines, a spoken phrase or voice sequence is first played, which is a single word or a whole sentence, for example. The person who is learning then repeats this played spoken phrase, which is received by the learning appliance through a microphone and is recorded. By alternately playing back the original spoken phrase and the repeated spoken phrase, the person who is learning can check whether he has repeated the spoken phrase correctly.

Currently, analog learning appliances are used, in which the spoken phrases are stored on analog cassettes. To this end, the analog learning appliances have cassette drives for inserting the analog cassettes. The cassette drive required for inserting the analog cassettes means that such analog learning appliances cannot be miniaturized as desired. In addition, the drive mechanism of the cassette drive requires a large amount of power, which means that inserted batteries do not last very long, i.e. their standby time is considerably shortened. In addition, the cassette drive is subject to mechanical wear phenomena, which means that the analog learning appliances are prone to needing repair, or losses of quality arise.

By contrast, digital learning appliances afford the advantage that the spoken phrases are stored in digital

memories, which means that no drive is required for inserting analog cassettes. Accordingly, inserted batteries last longer, the appliances are less prone to needing repair, and the quality of the spoken phrases is constant, since there are no mechanical parts which are subject to wear. To date, a great many analog learning cassettes for a wide variety of foreign languages have been recorded for analog learning appliances. Many customers already possess an extensive collection of analog learning cassettes with a wide variety of contents. To be able to render the contents of the already recorded analog learning cassettes useful for the digital learning appliances, the content of the analog learning cassettes needs to be recorded digitally by the digital learning appliance.

So that the person who is learning can access the various spoken phrases for learning quickly and with random access when using the digital learning appliance, an index needs to be produced for each spoken phrase. This spoken phrase index permits access to the associated spoken phrase, with the index storing the start and the end or the start and the length of the spoken phrase.

It is therefore the object of the present invention to provide a method for digitally recording an analog audio signal in which the digitally recorded audio signals are automatically indexed.

The invention achieves this object by means of a method having the features specified in patent claim 1 or 2.

The invention provides a method for digitally recording an analog audio signal with automatic indexing in which an analog audio signal containing audio information and signal pauses is read in, the analog audio signals are converted into digital audio data, with the audio data

comprising audio information data and signal pause duration data, and the audio information data are stored as information data blocks and the signal pause duration data are stored as signal pause data blocks in a memory,
the stored data blocks being read sequentially and a data structure for managing the indexing being produced or generated, any succession of information data blocks which is not interrupted by a signal pause with a predetermined duration being detected as one cohesive audio information data sequence whose start and end are stored in the data structure for managing the indexing.

The invention also provides a method for digitally recording an analog audio signal with automatic indexing in which an analog audio signal containing audio information and signal pauses is read in, the analog audio signals are converted into digital audio data, with the audio data comprising audio information data and signal pause duration data, the converted audio data are stored, the stored audio data are read sequentially, with a decision being made regarding whether the read digital audio data are audio information data or signal pause duration data, and the audio information data are stored as information data blocks and the signal pause duration data are stored as signal pause data blocks in a memory,
the stored data blocks being read sequentially and a data structure for managing the indexing being produced or generated, any succession of information data blocks which is not interrupted by a signal pause for a predetermined duration being detected as one cohesive audio information data sequence whose start and end are stored in the data structure for managing the indexing.

In the inventive method according to patent claim 2, the peak computation power required is lower because the decision regarding whether the audio data are audio

information data or signal pause duration data does not need to be made in real time by the processor. Another advantage is that various different data postprocessing methods or algorithms can be used alternatively on the stored audio data, and ultimately that algorithm which has the best result can be used.

In one preferred embodiment of the inventive method, the data structure produced for managing the indexing is an index table or an index list.

In one preferred embodiment of the inventive method, the digital audio data are compressed before storage.

In another preferred embodiment, each information data block contains an information data block identifier and audio information data, and each signal pause data block contains a signal pause data block identifier and signal pause duration data.

In accordance with one preferred embodiment of the inventive method, the start and end of a cohesive audio information data sequence are stored as start address for the first information data block and as end address for the last information data block within the memory in address pointers of the index table.

In another preferred embodiment of the inventive method, all the data blocks are of the same size and correspond to a particular basic unit of duration.

The basic unit of duration is preferably 30 ms.

In another preferred embodiment of the inventive method, a succession of information data blocks which is not separated by a signal pause data block whose signal pause duration data indicate a signal pause of

more than 2 s is detected as one cohesive audio data sequence.

In accordance with another preferred embodiment of the inventive method, the sequentially read data blocks are subjected to data processing during production of the index table.

This affords the particular advantage that the data processing of the digitally recorded data blocks does not take place in real time while the analog audio signal is being read in, but instead the data blocks which have already been digitally stored are postprocessed, which means that a multiplicity of different data analysis methods and data manipulation methods can be carried out on the data blocks without needing to proceed in real time. This reduces the necessary computation power which must be provided for the digital data processing.

In another preferred embodiment of the inventive method, a succession of information data blocks between two signal pause data blocks is filtered out if the number of information data blocks does not exceed a minimum value and the signal pause of the two signal pause data blocks exceeds a particular first time limit value.

This affords the advantage that brief noise or crackle, i.e. audio signals of very short duration, between two signal pauses is removed during recording. This additionally affords a considerable improvement in the splitting into spoken phrases during indexing.

Preferably, the minimum value is 1, i.e. one information data block between two signal pause data blocks of predetermined duration is filtered out, while just two successive information data blocks situated

between two signal pause data blocks are not filtered out.

This affords the advantage that only audio interference signals of very short duration are filtered out.

The signal pause data blocks' time limit value is preferably 0.5 s.

In another preferred embodiment of the inventive method, during the data processing, the signal duration data of signal pause data blocks whose signal pause duration exceeds a particular second time limit value are overwritten with signal duration data having a predetermined nominal signal duration.

Preferably, the second time limit value is 10 seconds and the nominal signal duration is 2 seconds.

This affords the particular advantage that, when turning over an analog cassette recorded on both sides for the purposes of digital recording, the long pause which inevitably arises in the process is transformed to a relatively short pause having the prescribed nominal signal duration of, for example, 2 seconds.

A preferred embodiment of the inventive method for digitally recording an analog audio signal with automatic indexing is described below with reference to the appended drawings in order to illustrate features which are fundamental to the invention.

In the drawings:

Figure 1 shows a block diagram to illustrate a digital learning appliance in which the inventive method is carried out;

Figure 2 shows a detail of the content of the digital learning appliance's digital memory shown in Figure 1;

Figure 3 shows an illustration to explain the formation of the index table in the inventive method;

Figure 4 shows an illustration to explain the data postprocessing for transforming long signal pauses into short signal pauses in accordance with the inventive method;

Figure 5 shows an illustration to explain the data postprocessing for filtering out information data blocks between signal pause data blocks to remove audio noise in accordance with the inventive method.

Figure 1 shows a digital learning appliance 1 in which the inventive method for digitally recording an analog audio signal with automatic indexing is carried out in accordance with the invention.

The digital learning appliance 1 contains an analog signal input 2 which is connected to an analog/digital converter 4 by means of a line 3. The analog/digital converter 4 is connected by means of a line 5 to a DSP processor 6 which is connected to a memory 8 by means of lines 7.

The analog signal input 2 of the digital learning appliance 1 can be connected to a conventional cassette player 10 by means of an analog line 9. The cassette player 10 contains a cassette drive into which an analog audio cassette 11 can be inserted. The digital learning appliance 1 additionally has a keypad (not shown) for operating it, loudspeakers and a power

supply. The memory 8 is preferably a nonvolatile programmable memory, in particular a flash memory.

To carry out the inventive method, the person inserts the analog audio cassette 11, containing spoken phrases for learning a foreign language, for example, into the cassette drive of the cassette player 10 and plays the analog audio cassette 11.

The analog audio signal output by the cassette player 10 contains audio information and signal pauses. The audio information is spoken information or music information. The analog audio signal is converted by the analog/digital converter 4 into digital audio data which comprise audio information data and signal pause duration data. The digital audio data are supplied via an internal line 5 to the DSP processor 6, which stores the audio information data as information data blocks and stores the signal pause duration data as signal pause data blocks in the memory 8, via the lines 7. The digital audio data are preferably subjected to data compression before storage in the memory 8.

Each stored information data block contains an information data block identifier I and audio information data. The stored signal pause data blocks for their part contain a signal pause data block identifier P and signal pause duration data.

Figure 2 shows a detail of the memory 8 after storage of the audio information data.

In the example shown in Figure 2, the shown memory detail of the memory 8 contains three information data blocks 8-1, 8-2, 8-3. The information data blocks each contain an information data block identifier I and audio information data AID.

A signal pause data block 8-4 has a signal pause data block identifier P and signal pause duration data SZD. Further information data blocks 8-5, 8-6, a signal pause data block 8-7 and further information data blocks 8-8, 8-9 and 8-10 are also shown.

The data blocks stored in this way are read sequentially by the DSP processor 6, and an index table is produced. In this context, any succession of information data blocks which are not interrupted by a signal pause having a predetermined duration is detected as one cohesive audio information data sequence. If the signal pause duration data SZD of the signal pause data block 8-4 indicate that the signal pause is below a predetermined minimum duration, for example 2 seconds, the succession of information data blocks 8-1, 8-2, 8-3 and the succession of information data blocks 8-5, 8-6 are detected as one cohesive audio information data sequence. A spoken phrase on a learning cassette contains short pauses in speech which result in short signal pauses. Such short signal pauses are suppressed when the index table is generated. The spoken phrase interrupted by a short pause in speech is nevertheless detected as a cohesive spoken phrase and is treated as one cohesive audio information data sequence when the index table is generated. When the index table is generated, the start and end of the cohesive audio information data sequence are preferably stored in a broad memory range of the memory 8 in an index table. In this context, the start of the cohesive audio information data sequence is preferably stored as a start address for the first information data block in a first address pointer of the index table, and the end of the cohesive audio information data sequence is stored as an end address for the last information data block within the memory in a second address pointer of the index table. The generated index table contains all the address pointers for the start and end addresses

for all cohesive audio information data sequences, i.e. for all cohesive spoken phrases.

The stored data blocks, i.e. the information data blocks and the signal pause data blocks, are preferably of the same size, i.e. they take up the same memory space, and correspond to a particular predetermined basic unit of duration. In this context, the basic unit of duration can be set in one preferred embodiment. The basic unit of duration is preferably 30 ms.

Figure 3 shows, schematically, the index table generation in the inventive method. A learning cassette contains a plurality of successive spoken phrases interrupted by relatively long pauses in speech of, for example, 2 seconds. In the example shown in Figure 3, the spoken phrase 2 contains two words interrupted by a short pause in speech of 0.5 seconds. The spoken phrase 2 is "Good morning", for example, the first word of the spoken phrase 2 "Good" being separated from the second word "morning" of the spoken phrase 2 by a short pause in speech of 0.5 s.

When the index table is generated, despite the presence of the short pause in speech of 0.5 s, the spoken phrase 2 is detected as one cohesive spoken phrase or audio information data sequence whose start and end are stored in the index table.

When the index table is generated, in preferred embodiments of the inventive method, the sequentially read data blocks are subjected to data processing or postprocessing.

During the data postprocessing, it is possible, as shown by way of example in Figure 4, for very long recorded signal pauses, which arise when the analog cassette is turned over in the drive of the cassette

player 10, for example, to be transformed into signal pauses of predefined length. If, by way of preference, the recorded signal pause is longer than a particular time limit value of 10 seconds, the signal duration data of the appropriate signal pause data block are overwritten with a predefined nominal signal duration, which is 2 seconds, for example. In the example shown in Figure 4, a signal pause of 30 seconds has been digitally stored, this signal pause having arisen by virtue of the analog learning cassette being turned over, for example. This unwanted long signal pause is transformed into a short signal pause of 2 seconds, because otherwise the person who is learning would need to wait 30 seconds for the next spoken phrase when using the digital learning appliance 30.

The digital postprocessing in accordance with one preferred embodiment of the inventive method removes brief noise, such as crackle. Figure 5 shows the removal of brief noise between two signal pauses by way of example. Preferably, a crackle or a brief pick-type noise is defined as a signal pause of at least 0.5 seconds in length followed by a single information data block followed, in turn, by a signal pause of at least 0.5 seconds in length. In the data postprocessing, the succession of information data blocks between two signal pause data blocks is filtered out if the number of information data blocks does not exceed a minimum value of 1 and the signal pause of the two signal pause data blocks situated in front and behind exceeds a particular time limit value of 0.5 s.

In one preferred embodiment of the inventive method, the minimum value and the time limit value can be set.

As shown in Figure 5, an information data block I is surrounded by two signal pause data blocks P1, P2, the first signal pause data block having a signal pause

duration of 0.7 seconds and the second signal pause data block P2 having a signal pause duration of 0.6 seconds. Between the two signal pause data blocks P1, P2 there is just one information data block, which is detected as noise or crackle, since the signal pause duration of the two adjacent signal pause data blocks P1, P2 both exceed the time limit value of 0.5 seconds.

The information data block I in Figure 5 is filtered out or erased during the data processing, and the two signal pause data blocks P1, P2 are replaced by a new signal pause data block P3 whose stored signal pause duration is the sum of the two signal pause durations stored in the original signal pause data blocks P1, P2.

Figures 4 and 5 show, by way of example, two possible data postprocessing operations on the digitally stored data blocks, with postprocessing taking place after the entire cassette content has been digitally stored. The data postprocessing therefore need not take place in real time, which considerably reduces the circuit complexity for the digital learning appliance.

The inventive method can be used for any desired audio signals, i.e. both for voice signals and for music signals. The analog audio signal can be read in from any desired analog storage medium or can originate from the analog signal output of a signal processing appliance.

In one preferred embodiment, the cassette player 10 plays the analog cassette 11 at increased speed, with the playing speed being doubled, for example. The doubled playing speed is detected by the digital learning appliance, preferably when the analog audio signal played at increased speed is read in. The analog audio signal played at increased speed is digitally converted and is stored in data blocks such that the

digitally stored audio signal is output at normal speaking speed for the person who is learning when the digital learning appliance is used. By way of example, speeded-up playing of the audio cassette is set or input by the operator using the keypad on the digital learning appliance 1.

In one alternative embodiment, the digital learning appliance 1 detects speeded-up playing of the audio cassette automatically.

Patent Claims

1. A method for digitally recording an analog audio signal with automatic indexing, having the following steps:
(a) an analog audio signal containing audio information and signal pauses is read in,
(b) the analog audio signal is converted into digital audio data comprising audio information data and signal pause duration data,
(c) the audio information data are stored as information data blocks and the signal pause duration data are stored as signal pause data blocks in a memory,
(d) the stored data blocks are read sequentially and a data structure for managing the indexing is produced,
any succession of information data blocks which is not interrupted by a signal pause with a predetermined duration being detected as one cohesive audio information data sequence whose start and end are stored in the data structure for managing the indexing.

2. A method for digitally recording an analog audio signal with automatic indexing, having the following steps:
a) an analog audio signal containing audio information and signal pauses is read in,
b) the analog audio signal is converted into digital audio data comprising audio information data and signal pause duration data,
c) the converted digital audio data are stored,
d) the stored digital audio data are read sequentially,
e) a decision is made regarding whether the read digital audio data are audio information data or signal pause duration data,

f) the audio information data are stored as information data blocks and the signal pause duration data are stored as signal pause data blocks in a memory,

g) the stored data blocks are read sequentially in order to produce a data structure for managing the indexing,

any succession of information data blocks which is not interrupted by a signal pause with a predetermined duration being detected as one cohesive audio information data sequence whose start and end are stored in the data structure for managing the indexing.

3. The method as claimed in claim 1 or 2, wherein the data structure produced for managing the indexing is an index table.

4. The method as claimed in claim 1 or 2, wherein the digital audio data are compressed before storage.

5. The method as claimed in claim 1 or 2, wherein each information data block contains an information data block identifier and audio information data, and each signal pause data block contains a signal pause data block identifier and signal pause duration data.

6. The method as claimed in one of the preceding claims, wherein the start and end of a cohesive audio information data sequence are stored as start address for the first information data block and as end address for the last information data block within the memory in address pointers of the index table.

7. The method as claimed in one of the preceding claims, wherein all the data blocks are of the

same size and correspond to a particular basic unit of duration.

8. The method as claimed in claim 7, wherein the basic unit of duration is 30 ms.

9. The method as claimed in one of the preceding claims, wherein a succession of information data blocks which is not separated by a signal pause data block whose signal pause duration data amount to a signal pause of more than 2 s is detected as a cohesive audio information data sequence.

10. The method as claimed in one of the preceding claims, wherein the sequentially read data blocks are subjected to data processing during production of the index table.

11. The method as claimed in one of the preceding claims, wherein, during the data processing, a succession of information data blocks between two signal pause data blocks is filtered out if the number of information data blocks does not exceed a particular minimum value and the signal pause of the two adjacent signal pause data blocks exceeds a particular first time limit value.

12. The method as claimed in claim 11, wherein the minimum value is 1.

13. The method as claimed in claim 11, wherein the first time limit value is 0.5 seconds.

14. The method as claimed in one of the preceding claims, wherein, during the data processing, the signal duration data of signal pause data blocks whose signal pause duration exceeds a particular second time limit value are overwritten with

signal duration data having a particular nominal signal duration.

15. The method as claimed in one of the preceding claims, wherein the second time limit value is 10 seconds and the nominal signal duration is 2 seconds.

16. The method as claimed in one of the preceding claims, wherein, when the analog audio signal is read in, the playing speed of the data medium on which the analog audio signal is recorded can be set.

GR 99 P 2312

Abstract

Method for digitally recording an analog audio signal with automatic indexing

A method for digitally recording an analog audio signal with automatic indexing, having the following steps: (a) an analog audio signal containing audio information and signal pauses is read in, (b) the analog audio signal is converted into digital audio data comprising audio information data and signal pause duration data, (c) the audio information data are stored as information data blocks and the signal pause duration data are stored as signal pause data blocks in a memory, (d) the stored data blocks are read sequentially and an index table is produced, any succession of information data blocks which is not interrupted by a signal pause with a predetermined duration being detected as one cohesive audio information data sequence whose start and end are stored in the index table.

Figure 1

GR 99 P 2312

List of References

1 Digital learning appliance
2 Analog input
3 Line
4 Analog/digital converter
5 Line
6 DSP processor
7 Lines
8 Memory
9 Analog line
10 Cassette player
11 Analog cassette

Attorney's Docket No.: 12816-031001
Client's Ref. No.: S1133

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled METHOD FOR DIGITALLY RECORDING AN ANALOG AUDIO SIGNAL WITH AUTOMATIC INDEXING, the specification of which:

[] is attached hereto.
[X] was filed on January 15, 2002 as Application Serial No. 10/031,471 and was amended on _____.

[X] was described and claimed in PCT International Application No. PCT/DE00/02294 filed on 07/13/2000 and as amended under PCT Article 19 on _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information I know to be material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

Country	Application No.	Filing Date	Priority Claimed
Germany	199.33.541.9	July 16, 1999	[X] Yes [] No

I hereby appoint the following attorneys and/or agents to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Attorney's Docket No.: 12816-031001
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Combined Declaration and Power of Attorney

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled METHOD FOR DIGITALLY RECORDING AN ANALOG AUDIO SIGNAL WITH AUTOMATIC INDEXING, the specification of which:

[] is attached hereto.
[X] was filed on January 15, 2002 as Application Serial No. 10/031,471 and was amended on _____.
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Attorney's Docket No.: 12816-031001
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Combined Declaration and Power of Attorney

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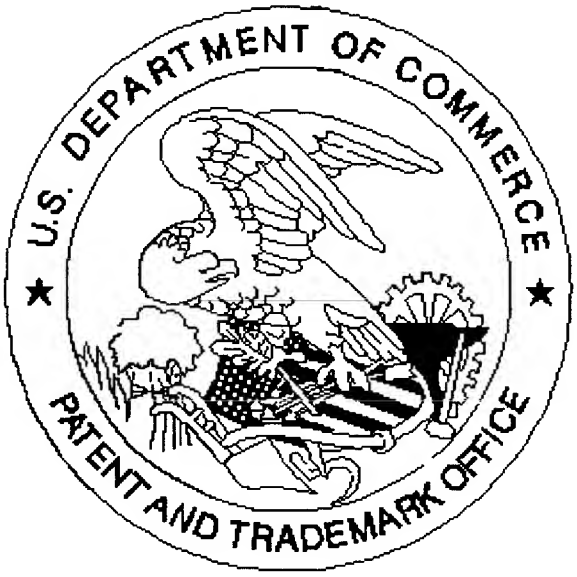

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